Forest Fire Case Study (ID) DMCC Working Group, APAN44th , Hongkong 2017

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Firewatch in Forestry

- Iniatiatited by Ministry of Forestry in the early 2001
- In 2009 collaboration between Indonesia and Australia (Landgate) for reducing the fire and hazard smoke
  - Ministry of Forestry , Ministry of Environment and Indonesia National Insitute of Aeronautics and Space (LAPAN)
  - Australia , LANDGATE
- Deliver the Data from satellite through Network (Inherent/NREN in 2010 – 2012)
  - Ministry of National Education
- In 2014
  - Burning from the Land in Sumatra and Kalimantan causes the smoke to other country
- In 2015
  - Burning from the peatland effected half of the world

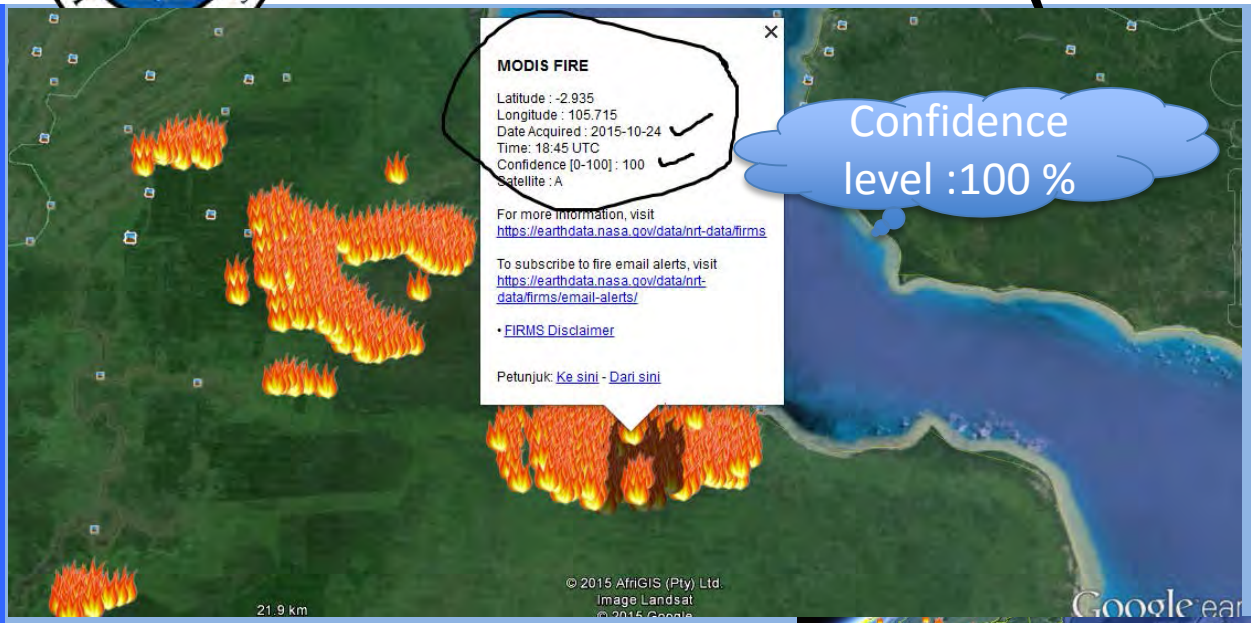
Firewatch Initiatives

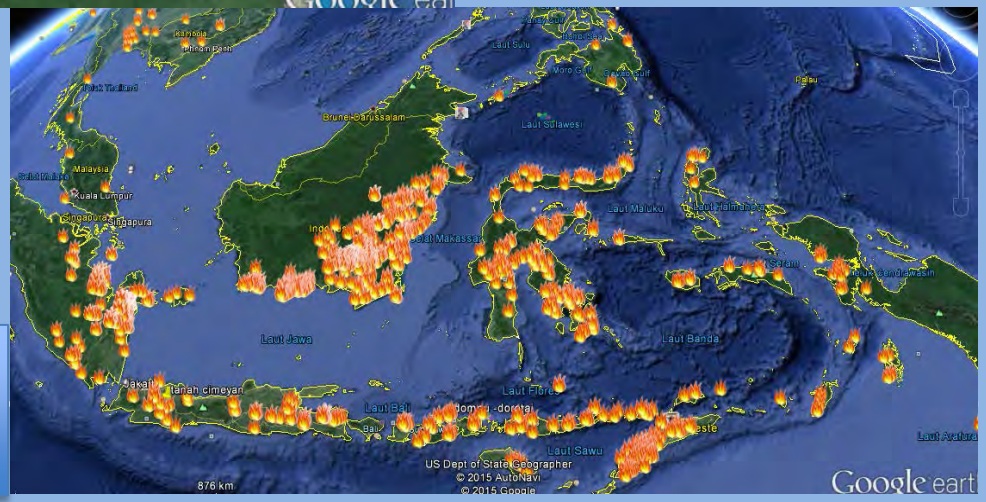
- Ministry of Forestry and LAND-gate Australia
  - MODIS-Data from NASA
- Collaboration Ministry Forestry with Ministry of Education (2010) for delivering the Hotspot information (Fire) through the Inherent (University of Palangkaraya and University of Riau)
- In 2015, ITB initiatives again for firewatch
  - Data Analysis through satellite
  - Sosialize the environment impact through the social media (Facebook/twitter)
  - Prevent air filter system solution in classroom
- In 2016
  - Prevent initiatives for building the near realtime model with Authomatic Weather System and Environment Sensor

Background

- Fire in the forestry
  - No AWS
  - No sensor connected
  - The MODIS Data came from satellite, within 24 hours
  - Visible Infrared Imaging Radiometer Suite (VIIRS) 375 m
  - Land Clearing on Coconut palm oil plantation
  - More than 10 Million Hectar on Indonesia

Google with KML's data from MODIS NASA (2015)

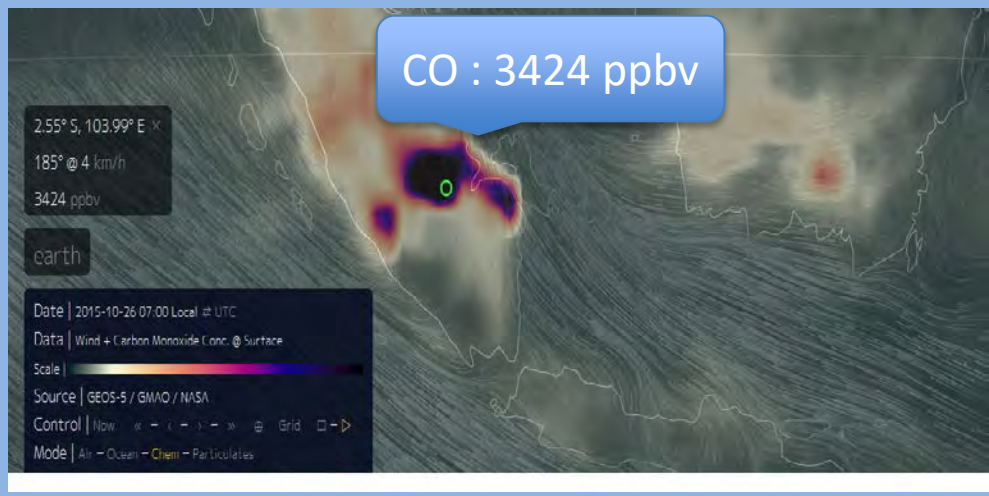




https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/active-fire-data

Earth.nullschool.net (2015)

- The Fire affected by the Wind direction and speed
- The indicators :
  - COsc , Carbon Monoxide surface concentration
  - Wind directions and speed
- a visualization of global weather conditions forecast by supercomputers updated every three hours
- Good as a models
- Need more precise informartion on the location affected



Global Firewatch

GLOBAL FOREST WATCH FIRES

Fire Report for Indonesia 18 Aug 2017 - 25 Aug 2017

SHARE

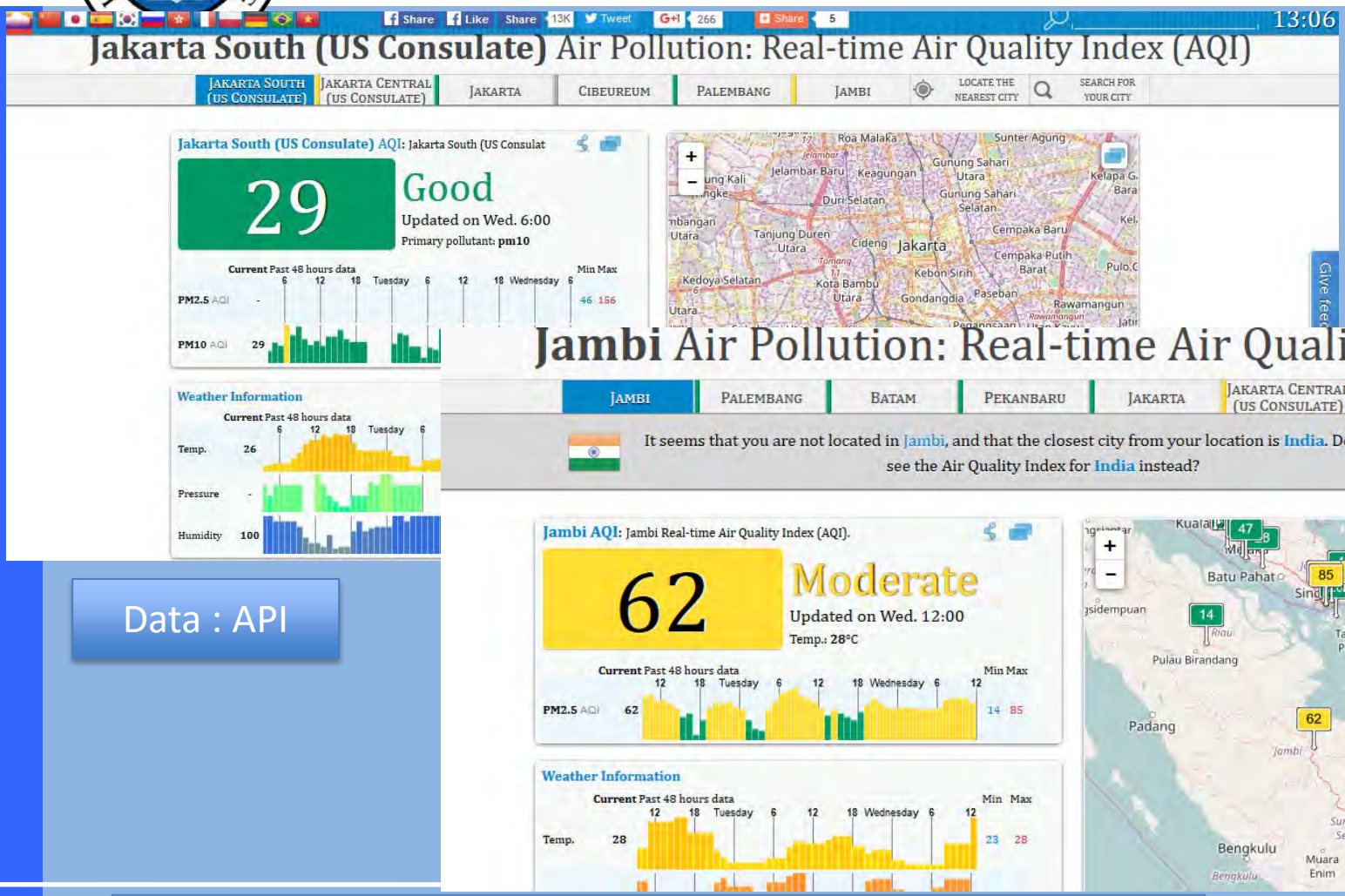
During this time period, there were **9,171** Fire Alerts

ceh, Bali, Bangka-Belitung, Banten, Bengkulu, Gorontalo, Jakarta Raya, Jambi, Jawa Barat, Jawa Tengah, Jawa Timur, Kalimantan
arat, Kalimantan Selatan, Kalimantan Tengah, Kalimantan Timur, Kepulauan Riau, Lampung, Maluku, Maluku Utara, Nusa Tenggara
arat, Nusa Tenggara Timur, Papua, Papua Barat, Riau, Sulawesi Barat, Sulawesi Selatan, Sulawesi Tengah, Sulawesi Tenggara,
ulawesi Utara, Sumatera Barat, Sumatera Selatan, Sumatera Utara, Yogyakarta

DISTRIBUTION OF FIRE ALERTS

- Special report for Indonesia(everyday) → 18-25 August 2017

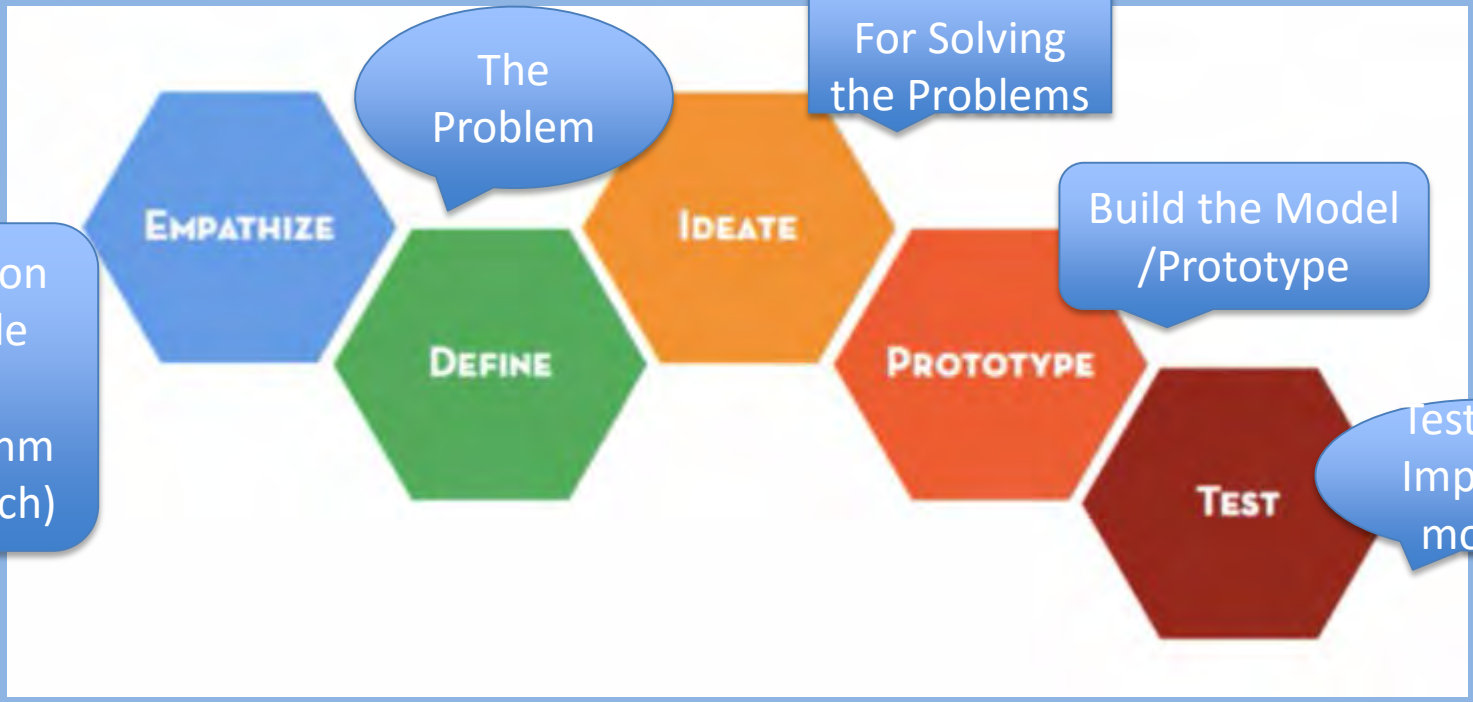
PM2.5 and PM10 sensor



Data : API

http://aqicn.org/city/indonesia/jakarta/us-consulate/south/

Concept (Design Thinking)



http://dschool.stanford.edu/

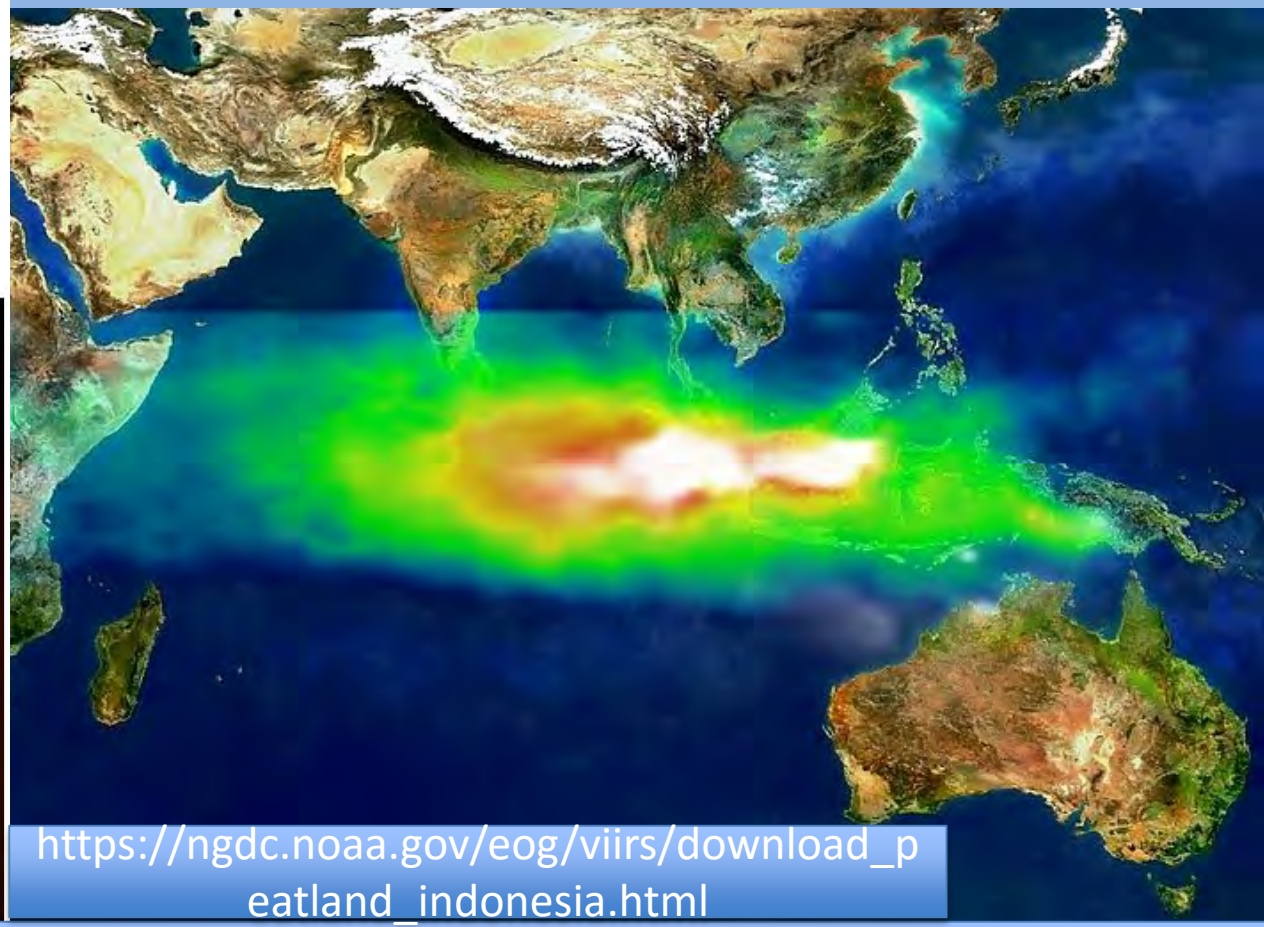
New Scientist (1 August 2016)

HOME NEWS TECHNOLOGY SPACE PHYSICS HEALTH EARTH HUMANS LIFE TOPICS EVENTS JOBS

5

DAILY NEWS 1 August 2016

Indonesian fires sent huge smoke plume halfway around the globe



https://ngdc.noaa.gov/eog/viirs/download_peatland_indonesia.html

https://www.newscientist.com/article/2099496-indonesian-fires-sent-huge-smoke-plume-halfway-around-the-globe/?utm_medium=Social&utm_campaign=Echobox&utm_source=Facebook&utm_term=Autofeed&cmpid=SOC%7cNS%7c2016-Echobox#link_time=1470082665

Define

- What we (Indonesia) need it ?
  - Automated Weather Station
    - Rainfall
    - Temperature
    - Humidity
  - Air quality Index and Polution Standard index measurements
    - NOx, SOx , CO , NH3 , O3 and PM 2.5 (10)
  - Sensors and sensors network
  - Prediction models
  - Socialize to peoples
  - Appropriate Technology for the Peoples

https://en.wikipedia.org/wiki/Pollutant_Standards_Index

IDeate

- By combining the satellite data with meteorological records, Field established that Indonesian fires often occur in association with the ultra-dry conditions in the region that accompany El Niño, a major cyclical weather system. These dry out the underlying peat to the point at which it can catch fire and can't be extinguished until monsoon rains arrive months later. A next step might be to refine the predictions further by including the combined effects of high temperatures and low humidity on peat moisture, says Field.
- He also found that less than 4 millimeters of rain per day during the annual dry season, from August to November – combined with El Niño conditions – seems to be a "tipping point" beyond which fires can to suddenly take off.

https://www.newscientist.com/article/2099496-indonesian-fires-sent-huge-smoke-plume-halfway-around-the-globe/?utm_medium=Social&utm_campaign=Echobox&utm_source=Facebook&utm_term=Autofeed&cmpid=SOC%7cNSNS%7c2016-Echobox#link_time=1470082665

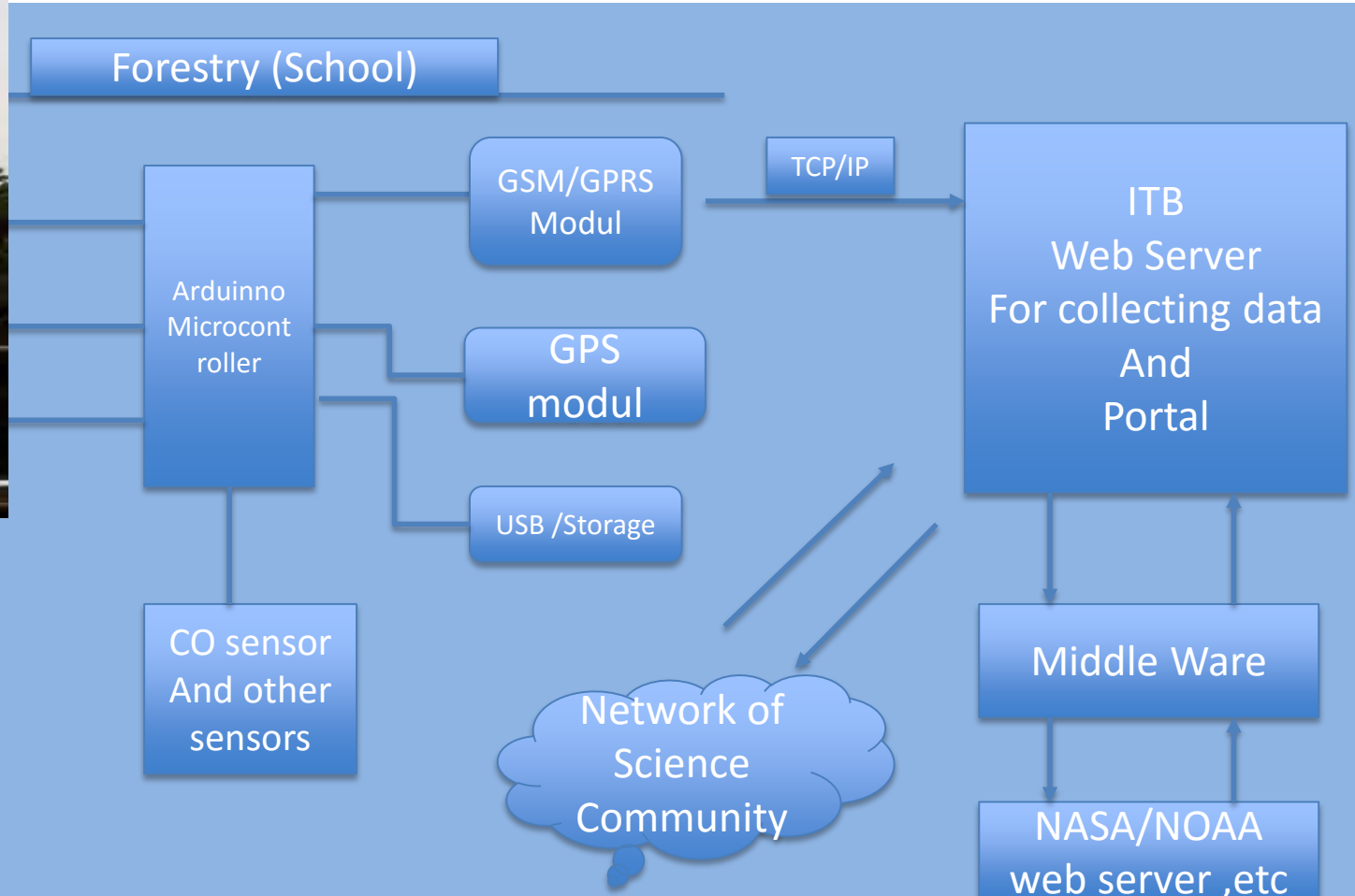
Contraints/obstacle

- In the field
  - There is no power
  - Limited converage by telecommunications system
  - No sensor available
- Source of the fire
  - More than 50 km from nearest

Build Prototype

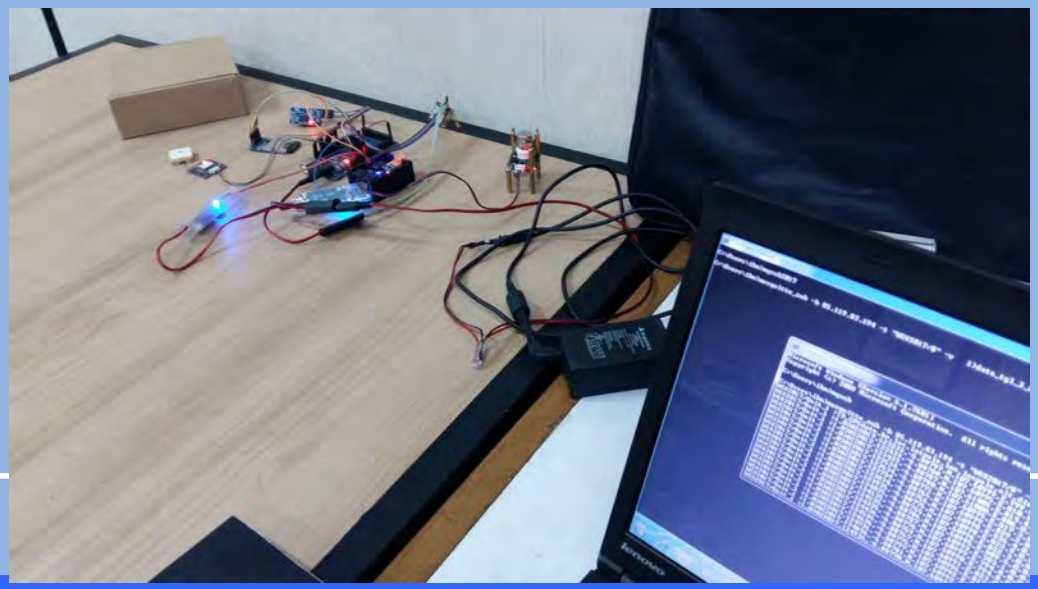
- Build prototype for AWS+sensor base on Arduino
  - Board (I/O)
  - Communication
    - GSM/GPRS/Wifi
    - Ethernet
    - USB/Storage System
  - Sensors
    - Temperature
    - Wind speed
    - Wind direction
    - Humidity
    - Rainfall rate
    - CO
    - Particulate Matters 2.5 and 10 Micron
    - CH4 ?
- Develop Service Oritented Services (SOA) for the
- Put the AWS in the area with near forestry/ peatland

Prototype 1.0 (2017)



Testing on the Lab

- AWS
  - Windspeed, wind direction, temperature, pressure, humidity, CO2 sensor ,etc
  - GSM /GPRS



ground

ne (GMT), alt,
nt, wind
speed,

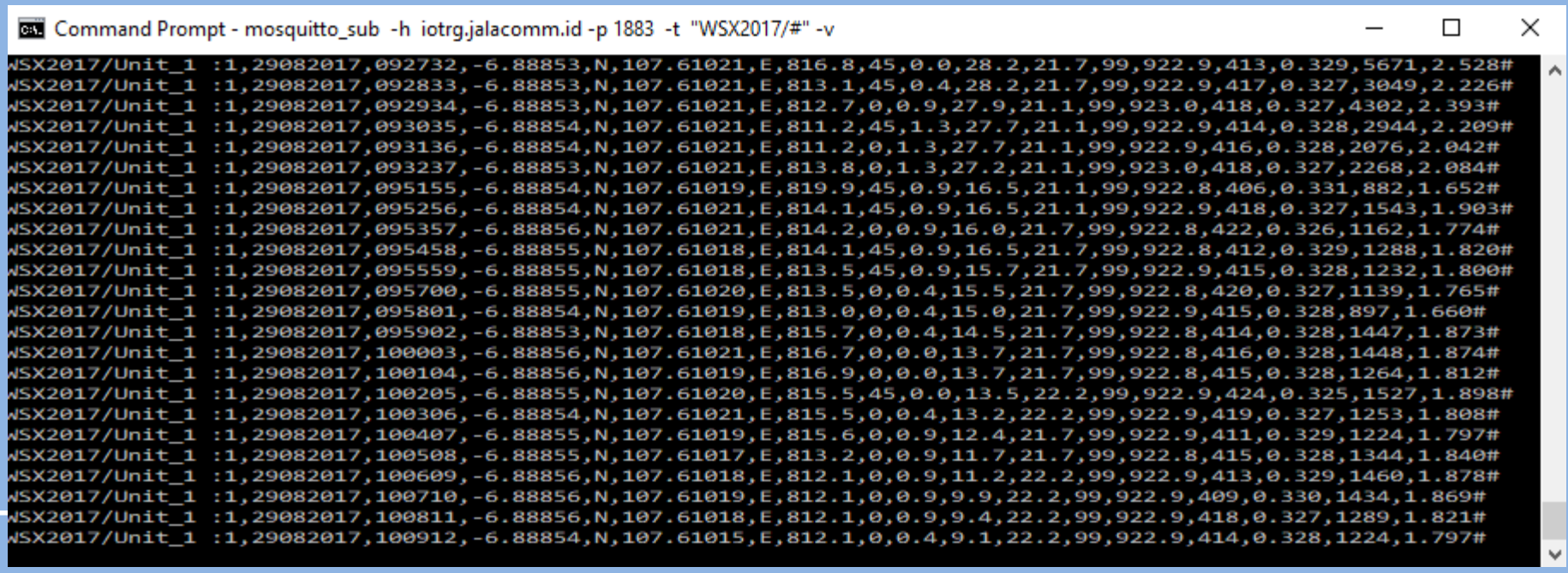
humidity ,
CH4

IOTserver

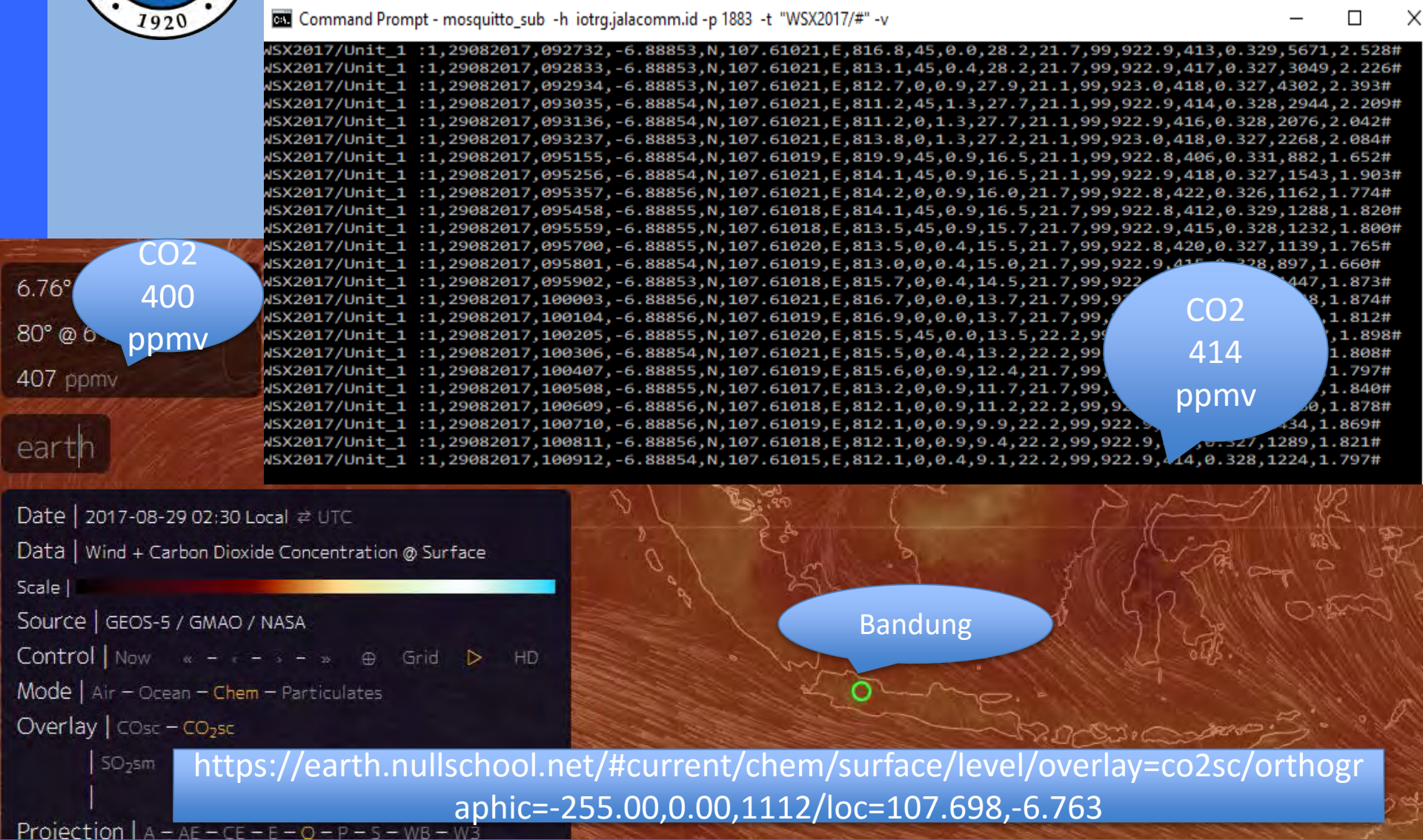
ver (WSO2)

Stream Data to server

- Data :
  - Per minutes
  - Push the data to the IOT server



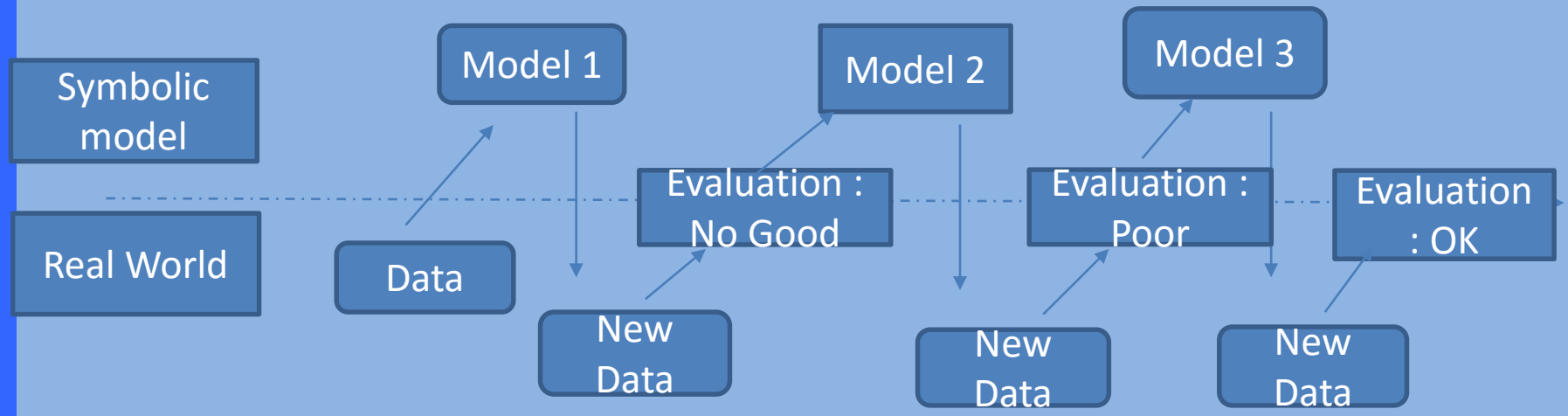
Compare data with earthnull



Testing on the field

- Testing in Near Oil Palm Plantation
  - Target in 5 Province
    - Riau
    - South Sumatra
    - West Kalimantan
    - Central Kalimantan
- Measure on reliability of the data and system

Model vs real world



The decision making process. Design for Decision by Irwin Bros, 1953 by Macmillian

Community Engagement and Support

- Government Support
  - Ministry of National Education
  - Ministry of Forestry and Environment
- University Support
  - Weather Modelling
  - Sekolah Bebas Asap (Reduce pollution index in Classroom)
- Community Support
  - Schools and Universities
  - Indonesia bebas asap (Smoke-Free Indonesia)

Background

- The smoke from wildfire in Sumatra and Kalimantan (peat land)
- The effect of the fire in Foresty effected untill more than 300 km from the source
- For example ; the source from the fire in South Sumatra and the effect of the smoke , CO and particulate matters (PM) until West Sumatra
- When haze came , school dismissed the students. This dangeorus because they do not come to safe places
- Several researcher from ITB initiatives to build safe class in class and building the haze protection system

Principle

Haze protection System

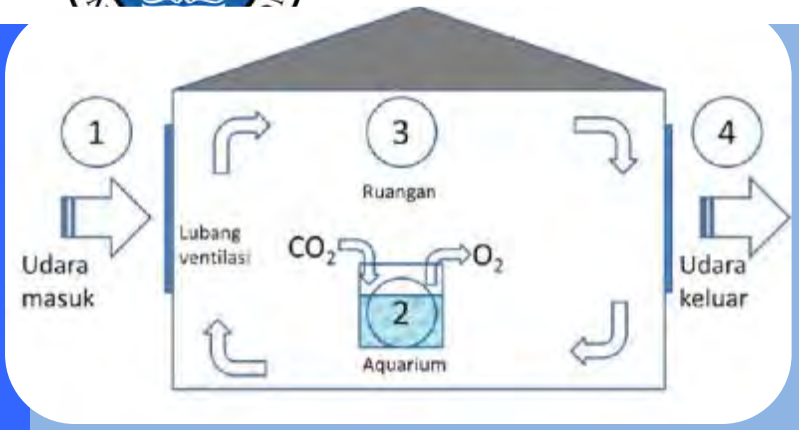
TERBUKTI (Proven)	Reduce air polution Index
MUDAH (Simple)	Simple implementation and maintenance
MURAH (Cost effectiveness)	Cheap mateial , easy to install
EDUKASI (Education)	The education's media for pupil /students
MUMPUNI dan KONTINYU (Reliable and Sustainable)	Can be used continuously after the smoke problem is finished

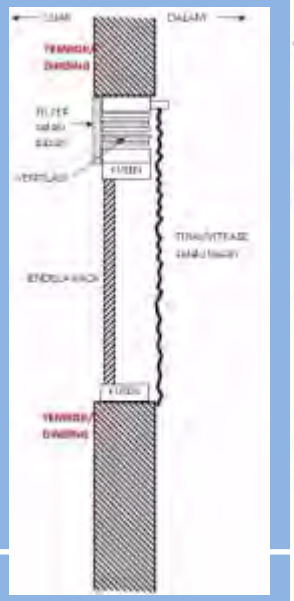
Trial

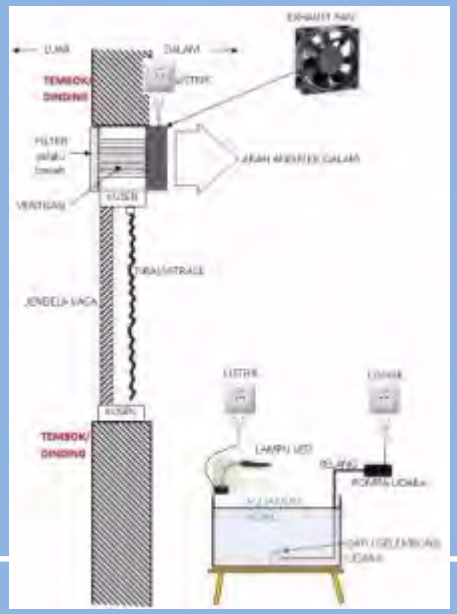
Location : SD Percobaan – Kota Padang

timeline : 27 – 28 Oktober 2015

Installation system







- Aquarium
- Kipas Angin
- Exhaust Fan
- Tumbuhan
- Air filter

Results

- Reduce Air Polution Index (PM)

✓Index on City (Padang) = 288
✓Index on the class room after installation = 78

President visited to School

Main Challenges (Future)

- Data sharing
  - Data are available only in web based information systems
  - Need to develop web services to make those data available to others
    - http://weather.meteo.itb.ac.id/aws.php is one example that have some of their data available to others using web service (by request)
- Build the model for reduce impact on Disaster
  - Fire on Forestry / Land fires
  - CO/CO2 models
  - PM (Particulate Mattes 2.5 micron)
- Build the Sensor Network
  - AWS (Automatic Weather Station)
  - Carbon Monoxide (CO)
  - Carbon Dioxide (CO2)
  - Particulate Matter
  - Methane
- Simuation on Environment impact peoples
- Build the collaboration with other parties
  - Gov , Academia, and Community

Thank You